Genomics: A Powerful Tool to Characterize Waterborne Pathogens

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Genomics is a rapidly expanding field of molecular biology that has captured the attention of the public and policymakers. A genome is the sum total of all an individual organism's genes. Thus, genomics is the study of all of the genes of a cell, or a tissue at a DNA (genotype), mRNA (transcriptome), and Protein (proteome) level. Genomics looks at the genes and their products as a dynamic system, in order to determine how the genes interact and influence biological activities, networks and physiology.

The Environmental Protection Agency (EPA) issued its Interim Policy on Genomics in June, 2002. This policy supports the preposition that genomics will have an enormous impact on the ability to assess the risk from exposure and ultimately to improve risk assessments. EPA expects that "genomics data may be received as supporting information for various assessment and regulatory purposes, e. g., identifying an environmental stressor's mode or mechanism of action." Genomic research tools permit the study of gene and protein expression changes in various organisms and their cells, or tissue, with specificity to the level of molecular function. As EPA's policy points out, genomics has the potential to be useful in at least three areas. First, it can help identify those persons in a population who have been impacted by environmental toxicants because affected individuals will show molecular changes (through DNA, RNA, or protein alterations) that can be measured. Second, it can be potentially valuable in screening chemicals for deleterious effects and prioritizing for further testing. Third, it could assist in elucidating the exposure-response continuum by revealing in greater detail how a compound acts to disrupt DNA or RNA or alter protein synthesis.

Toxicogenomics is an emerging science that studies the interaction between people's genes, toxic substances in the environment, and disease. It has the potential to revolutionize risk assessments and regulatory actions that rely on them, as well as to greatly advance the fields of toxicology and environmental health.

Microbial genomics will increase our understanding of how microbes contribute to health and disease of our bodies and natural environment. It will also promote advances in food production, bioremediation, and drug design. Investigators have already begun to tap into this tremendous store of knowledge. As the blossoming field of microbial genomics has begun to grow, various problems have become apparent. Many of these are typical of a rapidly expanding enterprise; others are specific to this new scientific arena.

This poster illustrates the current status of genomics and more specifically, the role of microbial genomics in characterizing waterborne pathogens.

The opinions expressed in this presentation are those of the authors and are not necessarily those of EPA.

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